

Design of a Single Cell Ebulliometer for Vapor Pressure Measurement up to 3 MPa

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Vapor pressure data is essential information for the design and analysis of engineering systems. Accurate fluid properties are required for dependable analyses. The motivation for the apparatus discussed in this paper is the development of a modified Mathias-Copeman α -function for the improvement of the Peng-Robinson equation of state, commonly used in industrial applications.

A metal ebulliometer is described, which can operate at up to 3 MPa in the temperature range of 0 to 150 °C. The design of the apparatus was greatly influenced by previous experimental work in this area. The ebulliometer is single cell, rather than comparative. However, the apparatus is designed such that future work can include a conversion to the comparative mode. The measurements required in the single cell mode include both temperature and pressure. The apparatus is designed for use in an industrial environment, where vapor pressure data can be determined in a timely manner.

Proof of principle measurements are presented for water and other well-established fluids. These measurements were conducted in order to verify the accuracy of the apparatus. Once the apparatus was shown to correctly reproduce the vapor pressure information for this set of fluids, new vapor pressure data was measured for the fluid n-perflourohexane. These data were used to develop a vapor pressure equation for the fluid.

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